

DECLARATION

We, IRENGE Mufungizi and DUFATANYENIMANA Sakina, we sincerely declare that this work entitled “ online bus ticket and place reservation “ submitted in a partial fulfilment required for the achievement of the bachelor’s degree in computer science at Kigali Independent University (ULK) GISENYI CAMPUS during the academic year 2017-2018, is a record of our original real work.

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APPROVAL

This is a dissertation submitted by IRENGE Mufungizi and DUFATANYENIMANA Sakina in partial fulfilment of the requirement for the award of a bachelor's degree in computer science at Kigali Independent University (ULK) Gisenyi campus during the academic year 2017-2018

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AKONOWLEDGEMENT

First of all, we sincerely thank the almighty God who protected us and guided us until we are done with this work. Foremost, we express our gratitude to our supervisor Mr. Eng. NSENGIYUNVA Juvenal for his guidance and immense knowledge. We also thank our brothers and sisters who helped us during the preparation of this work. We thank all people that supported us for the achievement of this work; May God blesses you.

TABLE OF CONTENT

DECLARATION.....	i
APPROVAL	ii
AKONOWLEDGEMENT	iii
TABLE OF CONTENT.....	iv
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	x
ABSTRACT.....	xi
CHAPTER I.GENERAL INTRODUCTION.....	1
1.1 INTRODUCTION.....	1
1.2 PROBLEM STATEMENT	1
1.3 PROJECT OBJECTIVES.....	2
1.3.1 General Objective	2
1.3.2 Specific objectives	2
1.4 CHOICE AND INTEREST OF THE STUDY	2
1.4.1 Choice of the study	2
1.4.2 Interest of the study.....	2
1.5 SCOPE OF THE PROJECT.....	3
1.6 PROJECT METHODOLOGY.....	3
1.6.1 Data collection technique.....	3
1.6.2 Software development methodology.....	3
1.6.3 System analysis and design method.....	4
1.7 ORGANIZATION OF THE PROJECT.....	4
CHAPTER II LITERATURE REVIEW	6
2.1 INTRODUCTION.....	6
2.2 BASIC CONCEPTS.....	6
2.2.1 Online.....	6
2.2.2 Bus	6
2.2.3 Ticket	6

2.2.5 Reservation	6
2.3 DATABASE CONCEPTS	6
2.3.1. Data	6
2.3.2. Database	6
2.3.5 Database management system (DBMS).....	7
2.3.4 Table	7
2.3.6 Records	7
2.3.7 Field	7
2.4.1 Attributes.....	7
2.4.2 Keys	7
2.4.3 Foreign key.	7
2.4.4 Primary key	8
2.4.5 Relational database	8
2.4.6 Entity.....	8
2.5 DATABASE IN NETWORK ENVIRONMENT	8
2.5.1Server	8
2.5.2 Client.....	8
2.5.3 client- server architecture.....	8
2.5.4 Web server	9
2.6 TOOLS, TECHNIQUES AND PROGRAMMING LANGUAGE	9
2.6.1 Pycharm	9
2.6.2 Xampp.....	9
2.6.3Mysql	9
2.6.4 Adobe Photoshop	9
2.6.5 HTML	9
2.6.6 CSS	9
2.6.7JavaScript.....	10
2.6.8 Python	10
2.6.9 Django framework	10
2.6.10 framework	10
2.6.11 Structured Query Language (SQL)	11
2.6.12 Bootstrap.....	11

2.6.13 MVC	11
2.8 SOME WEB APPLICATION ATTACKS	12
2.8.1 Credentials Management.....	12
2.7.2 CRLF Injection	12
2.7.3 Cross-Site Request Forgery	12
2.7.4 Cross-Site Scripting	12
2.7.5 Format String	12
2.7.6 SQL Injection.....	12
2.8 SOFTWARE DEVELOPMENT PROCESS MODELS.....	13
2.8.1 Waterfall Model	13
2.8.2 Prototyping.....	15
2.8.3. Iterative development model.....	16
2.8.4 Time boxing model	18
2.8.5 Agile model(extreme programming)	18
2.9 SUMMARY	19
CHAPTER III: SYSTEM ANALYSIS AND DESIGN.....	20
3.1 INTRODUCTION.....	20
3.2. ANALYSIS OF THE CURRENT SYSTEM	20
3.2.1. Introduction.....	20
3.2.2. Problem of the current system	20
3.3 ANALYSIS OF THE PROPOSED SYSTEM	21
3.3.1 Introduction.....	21
3.3.2 Benefits of the proposed system over the existing system.....	21
3.3.3 Methodological approach.....	21
3.3.4 Data collection techniques	22
3.3.5 Software development process model.....	22
3.4 SYSTEM REQUIREMENT.....	22
3.4.1 Functional requirement of the new system	22
3.4.2 Non-functional requirement of the new system	23
3.5 DESIGN OF NEW SYSTEM.....	23
3.5.1. Function Diagram	23
3.5.2 Dataflow diagram.....	23

3.5.3 Entity relationship diagram (ERD)	27
3.5.4 Data dictionary	28
CHAPTER IV: SYSTEM IMPLEMENTATION	32
4.1 INTERFACES OF THE SYSTEM	32
4.1.2 Home page	32
4.1.2. Search bus page.....	33
CHAPTER V: CONCLUSION AND RECOMANDATIONS	44
5.1. CONCLUSION	44
5.2. RECOMNDATION	44
5.3. FUTURE WORK	45
Bibliography	46
APPENDICES	48

LIST OF TABLES

Table 1: Data dictionary (auth_user, busarrival, bausdepart)	28
Table 2: Data dictionary (busInfo , Bookticket)	29
Table 3: Data dictionary(admin groups' permissions).....	30
Table 4: Data dictionary (admin, sessions and migrations)	31

LIST OF FIGURES

Figure 1: client server architecture.....	8
Figure 2: waterfall model.....	14
Figure 3: prototyping	16
Figure 4: Iterative model.....	17
Figure 5: timeboxing model.....	18
Figure 6: agile model	19
Figure 7:DEFD symbols	24
Figure 8:DFD level 0	24
Figure 9:DFD Level 1	26
Figure 10: Entity relationship	27
Figure 11: Home page.....	32
Figure 12: search bus	33
Figure 13: Ticket booking page	34
Figure 14: login page	35
Figure 15: payment page.....	36
Figure 16: Get your ticket	37
Figure 17: Customer profile.....	38
Figure 18: Admin login.....	39
Figure 19: Admin home page	40
Figure 20: Tickets	41
Figure 21: Adding the bus pick area	42
Figure 22: Adding the bus drop area.....	43

LIST OF ABBREVIATIONS

API:	Application programming interface
CSS:	Cascading style sheet
DB:	Database
DBMS:	Database management system
DFD:	Dataflow diagram
ERD:	Entity-Relationship Diagram
HTML:	Hypertext Mark-up Language
HTTP:	Hypertext Transfer Protocol
MVC:	Model View Controller
MVT:	Model View Template
RDBMS:	Relational Database Management System
SSADM:	Structured Systems Analysis and Design Method
SQL:	Structured Query Language
ULK	: Kigali Independent University
WWW	: World Wide Web

ABSTRACT

The purpose of this project is to design and implement a ‘’ Online Bus Ticket and Place Reservation for Virunga express bus agency. This project is limited to Virunga express.

This system gives the travellers the ability to reserve places and book their ticket while staying at home or in other business.

The data collection methodologies used in this project where the documentation and observation methods

The methodology used to understand and design the system is Waterfall Model.

We used the python programming language and other web technologies to develop this system

The system analysis and design methodology used in this work is the Structured System Analysis and Design Method (SSADM).

As the system is a web-based application, users need internet connection to use it.

The use of this system will reduce the time consuming, customer program failure, money consuming and it will also add the productivity to the Virunga express bus agency.

It is recommended to other researcher to continue developing this system in order to improve it functionalities.

The Virunga express bus transport agency is also recommended to continue using this system and inform their customer about it to make it benefit.

CHAPTER I: GENERAL INTRODUCTION

1.1 INTRODUCTION

Nowadays, due to the blessings and evolution of technology, there is growth in web applications in fact that it starts to help people in the sector of transportation to solve the traveller's problems. Travellers can now reserve their tickets, see the maps, see the program schedule and do more online thanks to this technology.

Virunga express is a bus transportation company located in Kigali, Gisenyi. It has worked many years ago and is among the very popular transport agencies located in Rwanda.

Virunga express usually have standalone desktop applications for keeping their customer's details and tickets, even for the whole staff records.

Customers always go to the bus stop to reserve their ticket for transport or call the company for any ticket reservation.

1.2 PROBLEM STATEMENT

Most of most of bus transportation companies in Rwanda use stand-alone applications so when customers need to reserve ticket or some other information they have to go to the agency office which is a waste of time, resource and program problem.

Virunga express customers always face the problems listed above because no ticket is accessible online because of their stand-alone system.

It is really difficult when a customer needs to reserve seat he or she need to call them or walk in to their counter which is consider as wasting their valuable times. It requires lots of time to travel to the bus stop to book a ticket, since everyone is leading busy life nowadays. Sometimes the phone line also keeps busy and customers unable to reserve seats for them.

1.3 PROJECT OBJECTIVES

This work has two kinds of objectives, the general objectives and the Particular objective

1.3.1 General Objective

Our general objective is to build a web-based application that will allow travellers to reserve their ticket and place online.

1.3.2 Specific objectives

The specific objectives are to:

- Increase the productivity of the company.
- Mange traveler's tickets online
- Replace the old reservation system with new system which is online based
- Reduce queue on the bus stop
- Real time report of ticket data in the organization
- Enhance the portability and accessibility of the application

1.4 CHOICE AND INTEREST OF THE STUDY

1.4.1 Choice of the study

The choice of this project result from the interest we have in the development of this country, Rwanda. Especially when we consider the advantage of the transportation in our everyday life we find that it is good to have transportation means but it's better to add an online based ticket reservation system to our transportation means.

1.4.2 Interest of the study

The study design and implementation of this system will help us to:

- Improve the web development skills and use them for real word problem solving
- Provide solution to the practical problems using knowledge gained from the particular class of system management databases and web design in our level of study
- Understanding better how computerized system work.

Social interest

- People will have the opportunity to book their ticket and reserve the places they want at any time because the system will be working 24/7.
- Virunga express agency will maximize profit growth.
So, the agency will maximize the ticket reservation.
- This system will help Virunga express company to easily manage customers' tickets as the record will be automatically generated

1.5 SCOPE OF THE PROJECT

The scope of this work is focused on Virunga express company, and will be dealing with customers who need to reserve their ticket online and the manager.

1.6 PROJECT METHODOLOGY

The development of such a kind of system needs data collection techniques and methodology

1.6.1 Data collection technique

- **Documentation technique**

For the development of this system on the side of documentation method for data collection, the text document and books will be used to carry out information needed to achieve the goal.

- **Observation technique**

Before the development of this system, the observation method will be used to carry out information and data.

So, we will go and observe how the current system works and what are the problems to be solved by the new system.

1.6.2 Software development methodology

In this project we will use the waterfall model development methodology and we will go through the following stages.

- System study
- System analysis
- System design

- Programming
- Testing
- Implementation
- Maintenance

1.6.3 System analysis and design method

We have chosen to use the structured system analysis design method (SSADM) which is a set of standards for systems analysis and application design that uses a formal methodical approach to the analysis and design of information systems. It will be used to specify functional and non-functional requirement, we will also use the Dataflow diagram (DFD)(KAGARAMA J. Batst, UMUTESI Liliane, 2018).

1.7 ORGANIZATION OF THE PROJECT

This work will contain five chapters as follow:

Chapter 1. General introduction

General introduction is the chapter that introduce the whole work, it explains the main objectives, the methodology used to make the work done, the scope and the objectives of the study

Chapter 2. Literature review

- In this chapter we select the appropriate measurement that will help to solve the problem and this will help to anticipate the most common problems to avoid repetition of same mistakes other researchers did before.
- It covers theories and the literature related to the topic.

Chapter 3. System analysis and design

This is the logical conception of the system, this covers the conceptually process of the solutions proposed to solve problems of the existing system. And we also analyse the existing environment and search for opportunity to improve the new system.

Chapter 4. System implementation

In this chapter we will be implementing the system and describe the architecture of the online bus reservation system in deep.

Chapter 5. Conclusion and recommendation

This chapter will conclude the development process and give recommendations

CHAPTER II LITERATURE REVIEW

2.1 INTRODUCTION

This chapter contains explanations of the basic information system concepts useful for the developer or user before it is developed. it has the aim of giving brief descriptions about the terms to be used during the development of the work.

2.2 BASIC CONCEPTS

2.2.1 Online

Online is the condition of being connected to a network of computers or other devices. The term is frequently used to describe someone who is currently connected to the Internet. (MARGUERET ROUSE, 2007)

2.2.2 Bus

A bus is a large motor vehicle carrying passengers by road, typically one serving the public on a fixed route and for a fare

2.2.3 Ticket

A piece of paper or card that gives the holder a certain right, especially to enter a place, travel by public transport, or participate in an event.(oxforddictionaries, 2018)

2.2.5 Reservation

Reservation is a customer's concluded arrangement with a goods or service supplier representing a completed sale.(businessdictionary, 2018)

2.3 DATABASE CONCEPTS

2.3.1. Data

Data can be defined as facts and statistics collected together for reference or analysis

2.3.2. Database

A database is a collection of information that is organized so that it can be easily accessed, managed and updated.

2.3.5 Database management system (DBMS)

Database management system (DBMS) is system software for creating and managing databases. The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.(Rouse, 2015)

2.3.4 Table

A database table is where all the data in a database is stored, and without tables, there would not be much use for relational databases.(Wenzel, 2014)

2.3.6 Records

In database management systems, a record is a complete set of information. Records are composed of field, each of which contains one item of information. (Beal, 2018)

2.3.7 Field

A field is an area in a fixed or known location in a unit of data such as a record, message header, or computer instruction that has a purpose and usually a fixed size.(Rouse, definition, 2005)

2.4 DATA MODELING

Data modeling is the process of creating a data model for the data to be stored in a Database.

2.4.1 Attributes

Each row is a data set that applies to a single item. Each column (attribute) contains describing characteristics of the rows. A database attribute is a column name and the content of the fields under it in a table in a database.(Chapple, 2018)

2.4.2 Keys

A key is a field, or combination of fields, in a database table used to retrieve and sort rows in the table based on certain requirements. Keys are defined to speed up access to data and, in many cases, to create links between different tables. 2.3.10 primary key

2.4.3 Foreign key.

Foreign key a field (or collection of fields) in one table that refers to the primary key in another table. A foreign key is used to link two tables.(www.w3schools.com, n.d.)

2.4.4 Primary key

A primary key is a unique identifier for a database record.

2.4.5 Relational database

A relational database is a database that treats all its data as collection of relations (Robbins, 1995)

2.4.6 Entity

An entity is any object in the system that we want to model and store information about. Entities are usually recognizable concepts, either concrete or abstract, such as person, places, things, or events which have relevance to the database. (www.sqa.org.uk, 2007)

2.5 DATABASE IN NETWORK ENVIRONMENT

2.5.1 Server

A server is a computer that provides data to other computers.

2.5.2 Client

A client is a piece of computer hardware or software that accesses a service made available by a server

2.5.3 client- server architecture

Client-server architecture is a computing model in which the server hosts, delivers and manages most of the resources and devices to be consumed by the client

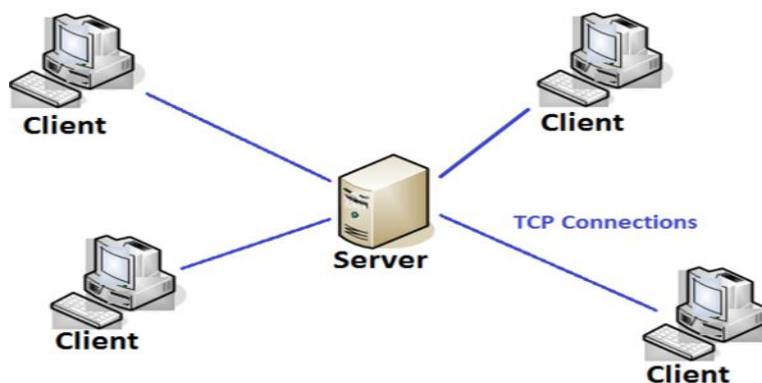


Figure 1: client server architecture

Source : www.cio-wiki.org

2.5.4 Web server

A web server is a system that delivers content or services to end users over the internet. A web server consists of a physical server, server operating system (OS) and software used to facilitate HTTP communication.

2.6 TOOLS, TECHNIQUES AND PROGRAMMING LANGUAGE

2.6.1 Pycharm

PyCharm is an integrated development environment (IDE) used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains.

2.6.2 Xampp

XAMPP is a free and open source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming language (www.wikipedia.com, 2018)

2.6.3Mysql

Mysql is a relational database management system. It does store data in separate table rather than putting all the data in one big storeroom.

2.6.4 Adobe Photoshop

Adobe Photoshop is a raster graphics editor developed and published by Adobe Systems for macOS and Windows.

2.6.5 HTML

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web (www.wikipedia.com, 2018)

2.6.6 CSS

CSS stands for Cascading Style Sheets CSS, it describes how HTML elements are to be displayed on screen, paper, or in other media

2.6.7 JavaScript

JavaScript often abbreviated as JS, is a high-level, interpreted programming language. It is a language which is also characterized as dynamic, weakly typed, prototype-based and multi-paradigm. (www.wikipedia.com, 2018)

2.6.8 Python

In technical terms, Python is an object-oriented, high-level programming language with integrated dynamic semantics primarily for web and app development. (pythonforbeginners.com, 2018)

2.6.9 Django framework

Django is a free and open source web application framework, written in Python. It follows the MVC pattern closely; however it does use its own logic in the implementation. Because the “C” is handled by the framework itself and most of the excitement in Django happens in models, templates and views, Django is often referred to as an MTV framework. In the MTV development pattern:

- **M stands for “Model,”** the data access layer. This layer contains anything and everything about the data: how to access it, how to validate it, which behaviors it has, and the relationships between the data. We will be looking closely at Django’s models in Chapter 4.
- **T stands for “Template,”** the presentation layer. This layer contains presentation-related decisions: how something should be displayed on a Web page or other type of document.
- **V stands for “View,”** the business logic layer. This layer contains the logic that accesses the model and defers to the appropriate template(s). You can think of it as the bridge between models and templates. (djangobook.com, 2018)

2.6.10 framework

A software framework is a universal, reusable software environment that provides particular functionality as part of a larger software platform to facilitate development of software applications, products and solutions.” (Shinde, 2017)

2.6.11 Structured Query Language (SQL)

SQL is a standard language for accessing and manipulating databases which stands for Structured Query Language

2.6.12 Bootstrap

Bootstrap is front-end web framework which includes HTML and CSS based design templates for easier development.

2.6.13 MVC

In object-oriented programming development, model-view-controller (MVC) is the name of a methodology or design pattern for successfully and efficiently relating the user interface to underlying data models. it has the following components:

- **Model**, which represents the underlying, logical structure of data in a software application and the high-level class associated with it. This object model does not contain any information about the user interface.
- **View** , which is a collection of classes representing the elements in the user interface (all of the things the user can see and respond to on the screen, such as buttons, display boxes, and so forth)
- **Controller**, which represents the classes connecting the model and the view, and is used to communicate between classes in the model and view

(Rouse, definition, 2013)

2.7 THE MODILE MONEY PAYMENT SYSTEM

MTN Mobile Money Online is an innovative way to send money from abroad to someone in Rwanda. The money is sent directly in to the receiver's Mobile phone, to the Mobile Money Account, and can then be used in various ways. (mtn.co.rw, 2018)

2.8 SOME WEB APPLICATION ATTACKS

We can end up this section without showing some problems that the website can encounter and some attacks to which the website is exposed.

2.8.1 Credentials Management

A credentials management attack attempts to breach username/password pairs and take control of user accounts.

2.7.2 CRLF Injection

CRLF Injection attacks refer to the special character elements "Carriage Return" and "Line Feed." Exploits occur when an attacker is able to inject a CRLF sequence into an HTTP stream. (veracode.com, 2018)

2.7.3 Cross-Site Request Forgery

Cross-Site Request Forgery (CSRF) is a malicious attack that tricks the user's web browser to perform undesired actions so that they appear as if an authorized user is performing those actions. (veracode.com, 2018)

2.7.4 Cross-Site Scripting

XSS vulnerabilities target scripts embedded in a page that are executed on the client-side (in the user's web browser) rather than on the server-side. (veracode.com, 2018)

2.7.5 Format String

Format String attacks occur when an application interprets data as a command and allows an attacker to access the underlying code base. (veracode.com, 2018)

2.7.6 SQL Injection

SQL injection is a type of web application security vulnerability in which an attacker is able to submit a database SQL command, which is executed by a web application, exposing the back-end database. (veracode.com, 2018)

2.8 SOFTWARE DEVELOPMENT PROCESS MODELS

Software development process models are various processes selected for the development of the project depending on the projects goals.

In software development process we distinguish the following process models:

1. waterfall
2. prototyping model
3. iterative development model
4. time boxing model
5. agile model (extremeprogramming.org, 1999)

2.8.1 Waterfall Model

Waterfall Model consists of a number of dependent phases that are executed in a sequential order. The complete solution is not released until the final phase.

This is the list of waterfall method process:

- Requirements analysis resulting in a software requirements specification
- Software design
- Implementation
- Testing
- Integration, if there are multiple subsystems
- Deployment (or Installation)
- Maintenance

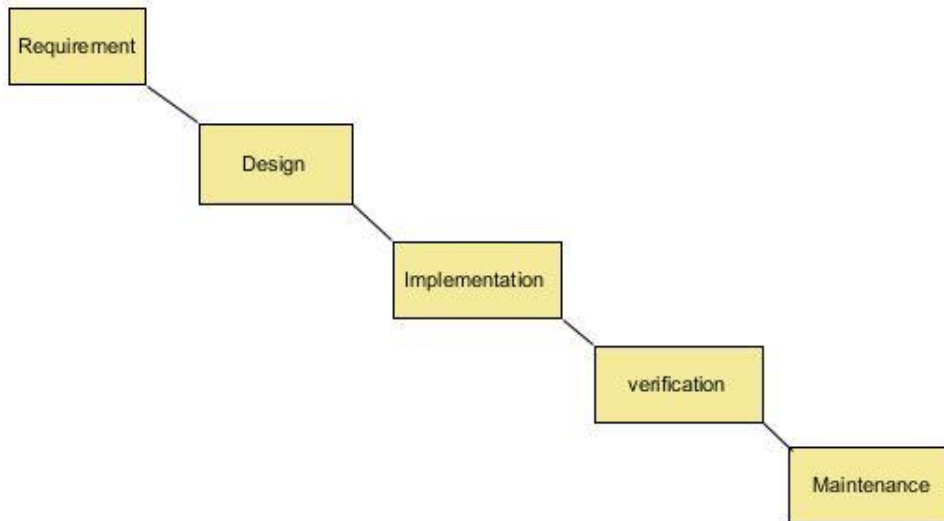


Figure 2: waterfall model

Source: own drawing

The basic principles are:

- Project is divided into sequential phases, with some overlap and splashback acceptable between phases.
- Emphasis is on planning, time schedules, target dates, budgets and implementation of an entire system at one time.
- Tight control is maintained over the life of the project via extensive written documentation, formal reviews, and approval/signoff by the user and information technology management occurring at the end of most phases before beginning the next phase. Written documentation is an explicit deliverable of each phase.

Advantages of waterfall model:

- This model is simple and easy to understand and use.
- It is easy to manage due to the rigidity of the model – each phase has specific deliverables and a review process.
- In this model phases are processed and completed one at a time. Phases do not overlap.

- Waterfall model works well for smaller projects where requirements are very well understood.

Disadvantages of waterfall model:

- Once an application is in the testing stage, it is very difficult to go back and change something that was not well-thought out in the concept stage.
- No working software is produced until late during the life cycle.
- High amounts of risk and uncertainty.
- Not a good model for complex and object-oriented projects.
- Poor model for long and ongoing projects.
- Not suitable for the projects where requirements are at a moderate to high risk of changing

2.8.2 Prototyping

The Prototyping Model is a systems development method (SDM) in which a prototype (an early approximation of a final system or product) is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system or product can now be developed. This model works best in scenarios where not all of the project requirements are known in detail ahead of time. It is an iterative, trial-and-error process that takes place between the developers and the users. (Rouse, definition, 2005)

There are several steps in the Prototyping Model:

- Requirement gathering: identify whatever requirements are known
- Outline areas where further definition is mandatory
- A quick design
- Construction of prototype
- Prototype is evaluated by the customer
- Requirements are refined, Prototype is tuned to satisfy the needs of customer

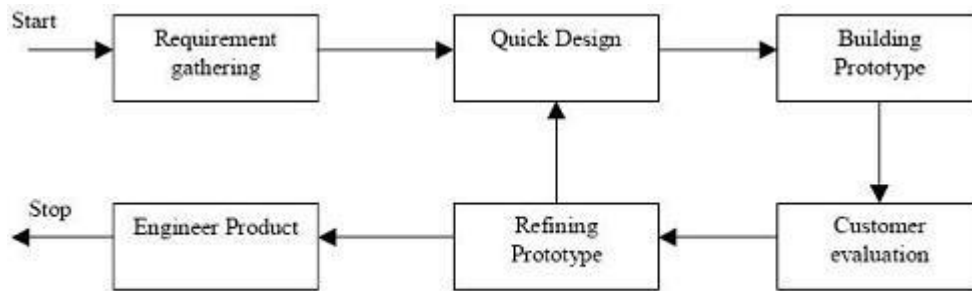


Figure 3: prototyping

Source: freetutes.com

Advantages of Prototyping

- Users are actively involved in the development
- It provides a better system to users, as users have natural tendency to change their mind in specifying requirements and this method of developing systems supports this user tendency.
- Since in this methodology a working model of the system is provided, the users get a better understanding of the system being developed.
- Errors can be detected much earlier as the system is made side by side.
- Quicker user feedback is available leading to better solutions.

Disadvantages

- Leads to implementing and then repairing way of building systems.
- Practically, this methodology may increase the complexity of the system as scope of the system may expand beyond original plans.(freetutes, 2018)

2.8.3. Iterative development model

Iterative development is a software development approach that breaks the process of developing a large application into smaller parts. Each part, called “iteration”, represents the whole development process and contains planning, design, development, and testing steps. Unlike the

Waterfall model, the iterative process adds features one-by-one, providing a working product at the end of each iteration, and increases functionality from cycle to cycle.

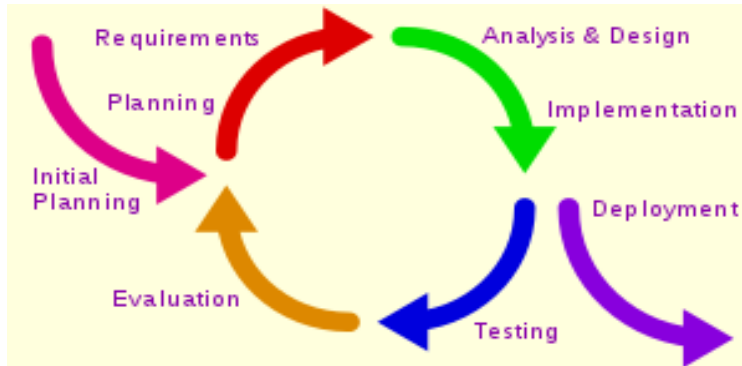


Figure 4: Iterative model

Source: en.wikipedia.org

Advantages of the iterative development

- Iterative software development means building the product step by step, which allows for the identification and correction of defects during the early stages, to avoid their downward flow into further processes.
- With iterative development at the end of each stage you can get user feedback, such as how they see the product now and what they are expecting it to look like in the future. This allows you to make any necessary improvements and amendments.
- The iterative development approach helps you to save time on documentation, which often accompanies the waterfall workflow, and to focus more on designing the project.

Disadvantages of the iterative development

- Although the whole iterative process is quite flexible, iteration phases are rigid and have to be followed carefully.
- Unpredictable changes may occur during the iterative development because not all the requirements are specified from the very beginning of the project. (easternpeak.com, 2018)

2.8.4 Time boxing model

In time boxing model, development is done iteratively as in the iterative enhancement model.

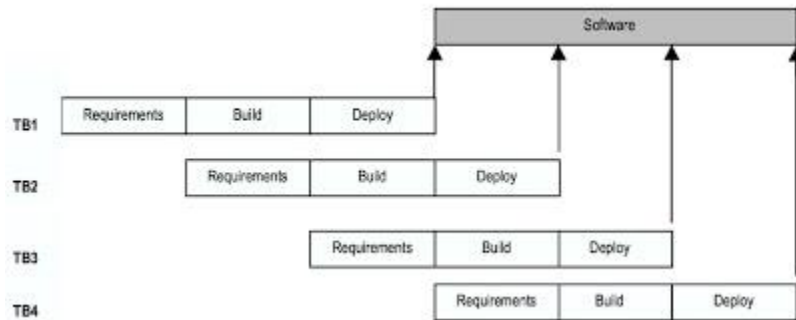


Figure 5: timeboxing model

Source: rpl-blog.blogspot.com

Advantages

- Speeds up the development process and shortens the delivery time
- Well suited to develop projects with a number of features in short time period.

Disadvantages

- Project management becomes more complex.
- Not suited to projects in which entire development work cannot be divided into multiple iterations of almost, equal duration.(Amachu, 2013)

2.8.5 Agile model(extreme programming)

Extreme Programming (XP) is an agile software development framework that aims to produce higher quality software, and higher quality of life for the development team. Dynamically changing software requirements

- Risks caused by fixed time projects using new technology
- Small, co-located extended development team

- The technology you are using allows for automated unit and functional tests.
(extremeprogramming.org, 1999)

The extreme programming release cycle

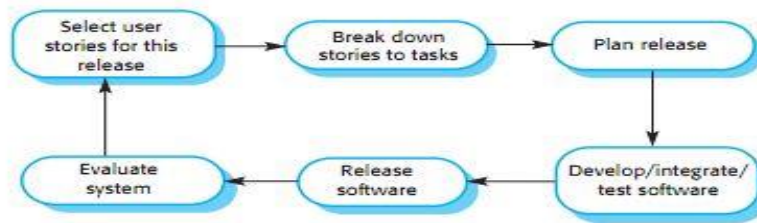


Figure 6: agile model

Source: bmyr.wordpress.com

2.9 SUMMARY

This chapter called literature review is the part in which we reviewed some theories developed by other researchers in the equivalent topics in order to improve the user system satisfaction and the system performance. We also mentioned some tools and techniques to be used in the our system to achieve our goal as said above.

CHAPTER III: SYSTEM ANALYSIS AND DESIGN

3.1 INTRODUCTION

The target of our research deals with the creation an online system that will allow travellers to reserve their tickets via the internet. In this part we will deal with two main subjects, the analysis of the system and the design of the system.

- The system design phase is the phase in which we and the system users are consulted to gather and interpret facts and diagnosing the existing problem and using the found information to propose the improvement on how the system must work, what are the system futures and what are the operation that have to appear in the system. So, we will analyze the organization activities monitoring and come out with solutions to be accomplished by the system.
- In the system design, we will take the ideas found by the system analysis to form the template of the new system.

3.2. ANALYSIS OF THE CURRENT SYSTEM

In this part we will analyse the existing system and it problems.

3.2.1. Introduction

Virunga express is among the most known transport agency, it has many branches in Rwanda and operate in all provinces. We analyse their system and we fund that when customers want to reserve a ticket he or she has to go to the agency office or call the agency number to reserve it and say the time he will leave in order to travel at a specific time so he will not find the bus full and unable to receive customers.

3.2.2. Problem of the current system

Here is a list of the current system's drawbacks that emphasise the need of a new system.

1. Customer's travel program failure

So many time it happens that the traveler needs to reserve his ticket for a urgency purpose and don't have time to go to the agency and when he call the phone agency he got a call failure and that lead to program failure.

2. Waste of time

When a customer has future urgent program and still working in an other life duty, he need to reserve a ticket to travel when the precise time will arrive. So many time it happens that the customer has to go to the agency and reserve their ticket which is a waste of time

3. Money consumption

Travelling twice for ticket reservation is a waste of money which could be solved by a one click on the application to reserve a ticket using some Mega-bites which are less expensive than a transportation mean.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

3.3.1 Introduction

The new system called 'online bus ticket reservation' is implemented to solve the problem of custom's program failure, waste of time and money consuming problems. So this analysis chapter will answer what the system will do, where and when it will be used by identifying improvement opportunity and develops a concept to achieve the system objectives listed above.

3.3.2 Benefits of the proposed system over the existing system

The benefit of this new system is that is will be accessed everywhere since it is a web application and this allow the manager and customer to work without limits of time

3.3.3 Methodological approach

Methodology is a formal development process that define a set of activities, methods, practices, deliverables that are used by the developer and project manager to implement information systems.

3.3.3.1 Structured system analysis and design

Structured systems analysis and design methodology (SSADM) is a set of standards for systems analysis and application design that uses a formal methodical approach to the analysis and design of information systems. SSADM follows the waterfall life cycle model starting from the feasibility study to the physical design stage of development. One of the main features of SSADM is the intensive user involvement in the requirements analysis stage.(techopedia, 2017)

3.3.4 Data collection techniques

Documentation technique

By the documentation technique researcher consulted books, reviews, memories, class notes and web pages related to this project.

Observation technique

Using this technique, we visited the company to see and conclude what are the problems and what happens in the existing system in order to come up with sufficient data.

3.3.5 Software development process model

Software development process models are various processes selected for the development of the project depending on the projects goals. Among those software development process models, we have chosen to use the waterfall model

3.3.5.1. The waterfall models

Waterfall Model consists of a number of dependent phases that are executed in a sequential order. The complete solution is not released until the final phase.

So that is the model that we will use in the design of the new system.

3.4 SYSTEM REQUIREMENT

3.4.1 Functional requirement of the new system

Functional requirements are the specific functions that the system performs during its usage.

Examples of some functional requirements are listed below:

- The system shall be able to authenticate users,
- The system shall be able to keep users' data until it is deleted by the owner or the administrator
- The system shall allow users to print their tickets
- The system will allow the admin to manage all users and their bookings, it will allow him to create, delete, update and read users, buses and the tickets.

3.4.2 Non-functional requirement of the new system

The non-functional requirements are the system behaviours other than the specific functions.

Here is the list of non-functional requirements:

- The system shall be user -friendly
- The system shall have a interactive interface
- The system must be responsive, that means that the system will not only be working in computers but also in mobile phone and other specified screens.
- The system shall present a readable interface

Description

The system is a web-based application that allows visitors to reserve seats, buy and pay ticket online. It is developed using python programming, Mysql database, Django python web framework and other web technologies.

3.5 DESIGN OF NEW SYSTEM

In order to design the new system, we will deal with the function diagram, context-diagram, data flow diagram level 1 and entity relationship diagram. Here the structures of the described diagrams.

3.5.1. Function Diagram

A function diagram in software engineering is a block diagram that describes the functions and interrelations of a system.

3.5.2 Dataflow diagram

Data Flow Diagramming is a graphical representation of data through an information system .is one of the tools used in Software design representing a system at any level of detail with a graphic network of symbols showing data flows, data stores, data processes, and data sources/destinations.

DFD symbols

It has the following symbols:

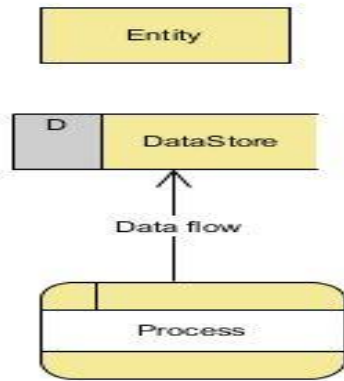


Figure 7:DEFD symbols

DFD LEVEL 0

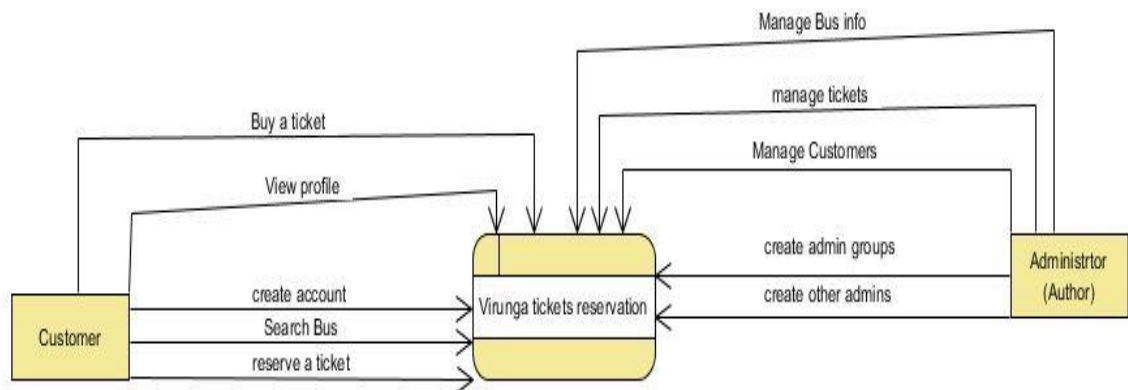
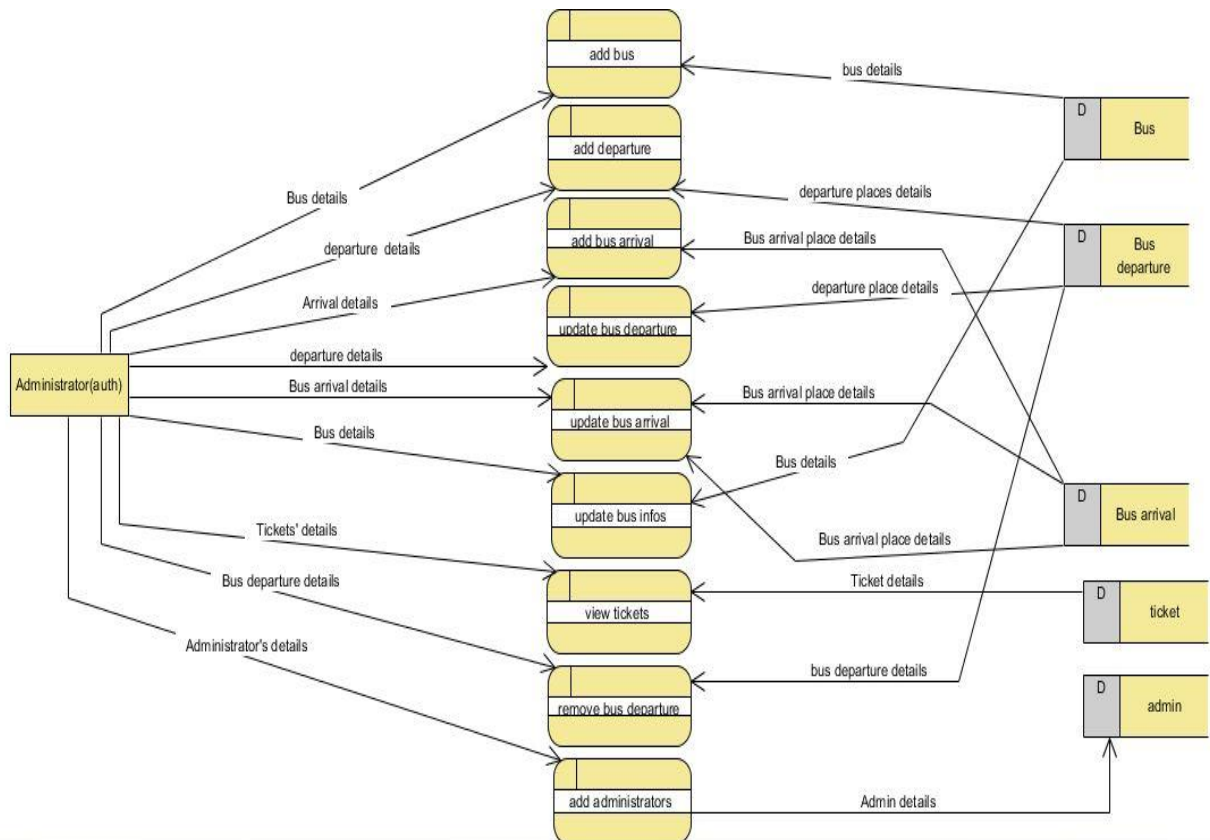
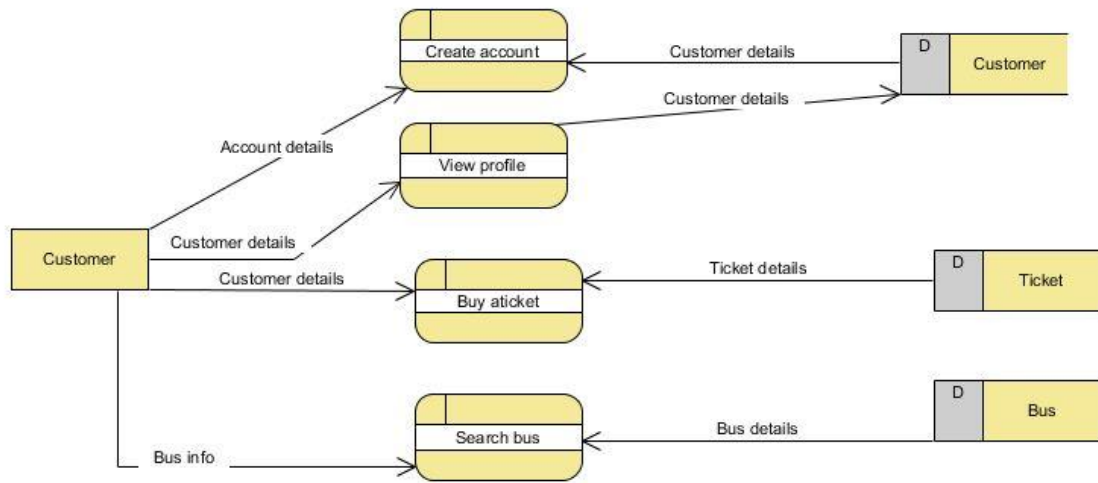


Figure 8:DFD level 0

Source: own drawing

DFD LEVEL 1



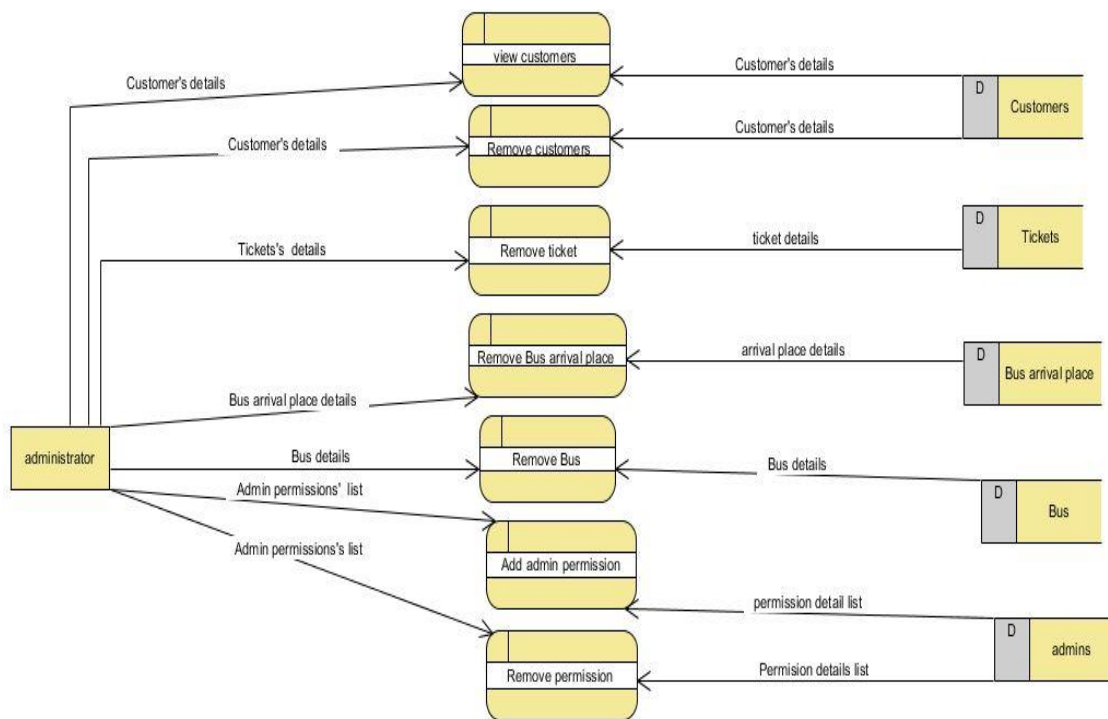


Figure 9:DFD Level 1

Source: own drawing

Source: own drawing

3.5.4 Data dictionary

A data dictionary is a set of information describing the contents, format, and structure of a database and the relationship between its elements, used to control access to and manipulation of the database.

Table 1: Data dictionary (auth_user, busarrival, busdepart)

Entity	Column	Type	KeyName	Null
Auth_user(admin/user)	id	int(11)	No	No
	password	varchar(128)	No	No
	last_login	datetime(6)	Yes	Yes
	is_superuser	tinyint(1)	No	No
	username	varchar(150)	No	No
	first_name	varchar(30)	No	No
	last_name	varchar(150)	No	No
	email	varchar(254)	No	No
	is_staff	tinyint(1)	No	No
	is_active	tinyint(1)	No	No
	date_joined	datetime(6)	No	No
busarrival	id	int(11)	Primary	No
	area_name	varchar(50)		No
	slug	varchar(255)		No
	created_at	datetime(6)	No	
	updated_at	datetime(6)	No	
busdepart	id	int(11)	Primary	No
	area_name	varchar(50)		No
	slug	varchar(255)		No
	created_at	datetime(6)	No	
	updated_at	datetime(6)	No	

Table 2: Data dictionary (busInfo , Bookticket)

Entity	Column	Type	KeyName	Null
Businfo	id	int(11)	Primary	No
	bus_name	varchar(50)		No
	slug	varchar(255)		No
	bus_description	longtext		No
	type	varchar(10)		No
	arriving_time	time(6)		No
	depature_time	time(6)		No
	fare	decimal(9,2)		No
	no_of_seats	int(11)		No
	is_active	tinyint(1)		No
	created_at	datetime(6)		No
	updated_at	datetime(6)		No
	image	varchar(100)		No
	arriving_from_id	int(11)	Foreign	No
	depature_at_id	int(11)	Foreign	No
bookticket_bookaticket	id	int(11)	Primary	No
	booking_date	datetime(6)		No
	status	varchar(2)		No
	ip_address	char(39)		No
	last_updated	datetime(6)		No
	date	datetime(6)		No
	email	varchar(50)		No
	phone	varchar(20)		No
	booking_seats_num	int(11)		No
	fare	decimal(9,2)		No
	bus_id	int(11)	Foreign	No
	user_id	int(11)	Foreign	No

Table 3: Data dictionary(admin groups' permissions)

Entity	Column	Type	KeyName	Null
auth_group	id	int(11)	Primary	No
	name	varchar(80)		No
auth_group_permission	id	int(11)	Primary	No
	group_id	int(11)	Foreign	No
	permission_id	int(11)	Foreign	No
auth_permission	id	int(11)	Primary	No
	name	varchar(255)		No
	content_type_id	int(11)	Foreign	No
	codename	varchar(100)		
auth_permission	id	int(11)	Primary	No
	name	varchar(255)		No
	content_type_id	int(11)	Foreign	No
	codename	varchar(100)		
auth_user_groups	id	int(11)	Primary	No
	user_id	int(11)	Foreign	No
	group_id	int(11)	Foreign	No
auth_user_user_permission	id	int(11)	Primary	No
	user_id	int(11)	Foreign	No
	permission_id	int(11)	Foreign	No

Table 4: Data dictionary (admin, sessions and migrations)

Entity	Column	Type	KeyName	Null
django_admin_log	id	int(11)	Primary	No
	action_time	datetime(6)		No
	object_id	longtext		Yes
	object_repr	varchar(200)		No
	action_flag	smallint(5)	UNSIGNED	No
	change_message	longtext		No
	content_type_id	int(11)		Yes
	user_id	int(11)	Foreign	No
django_content_type	id	int(11)	Primary	No
	app_label	varchar(100)		No
	model	varchar(100)		No
django_session	session_key	varchar(40)		No
	session_data	longtext		No
	expire_date	datetime(6)		No
django_migrassions	id	int(11)	Primary	No
	app	varchar(255)		No
	name	varchar(255)		No
	applied	datetime(6)		No

CHAPTER IV: SYSTEM IMPLEMENTATION

This chapter is focused on the implementation of the new system; it describes the working application from print screens and show the major interactive or important part of the system .

4.1 INTERFACES OF THE SYSTEM

4.1.2 Home page

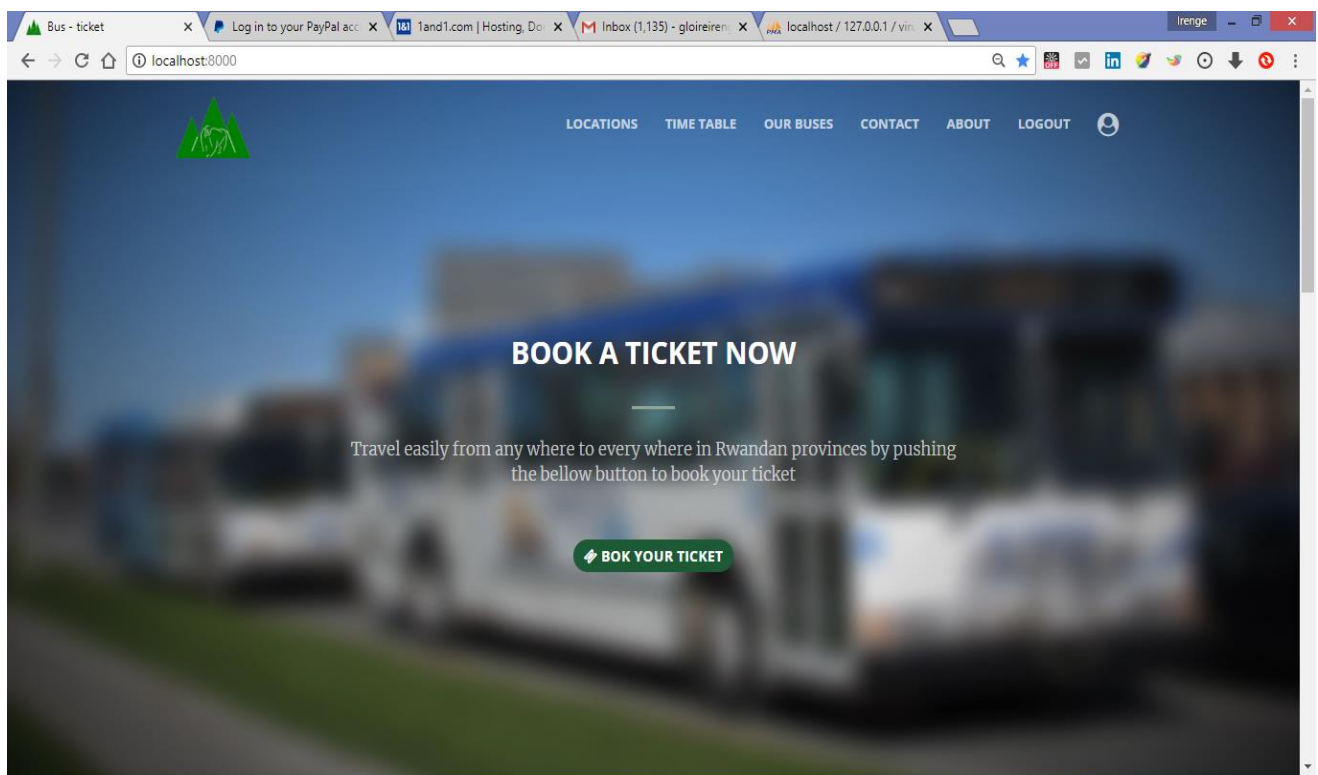


Figure 11: Home page

Source: Own drawing

The above page is the home page that provides the menu, different information about the bus company and a book a ticket button that leads the user to the bus searching form.

4.1.2. Search bus page

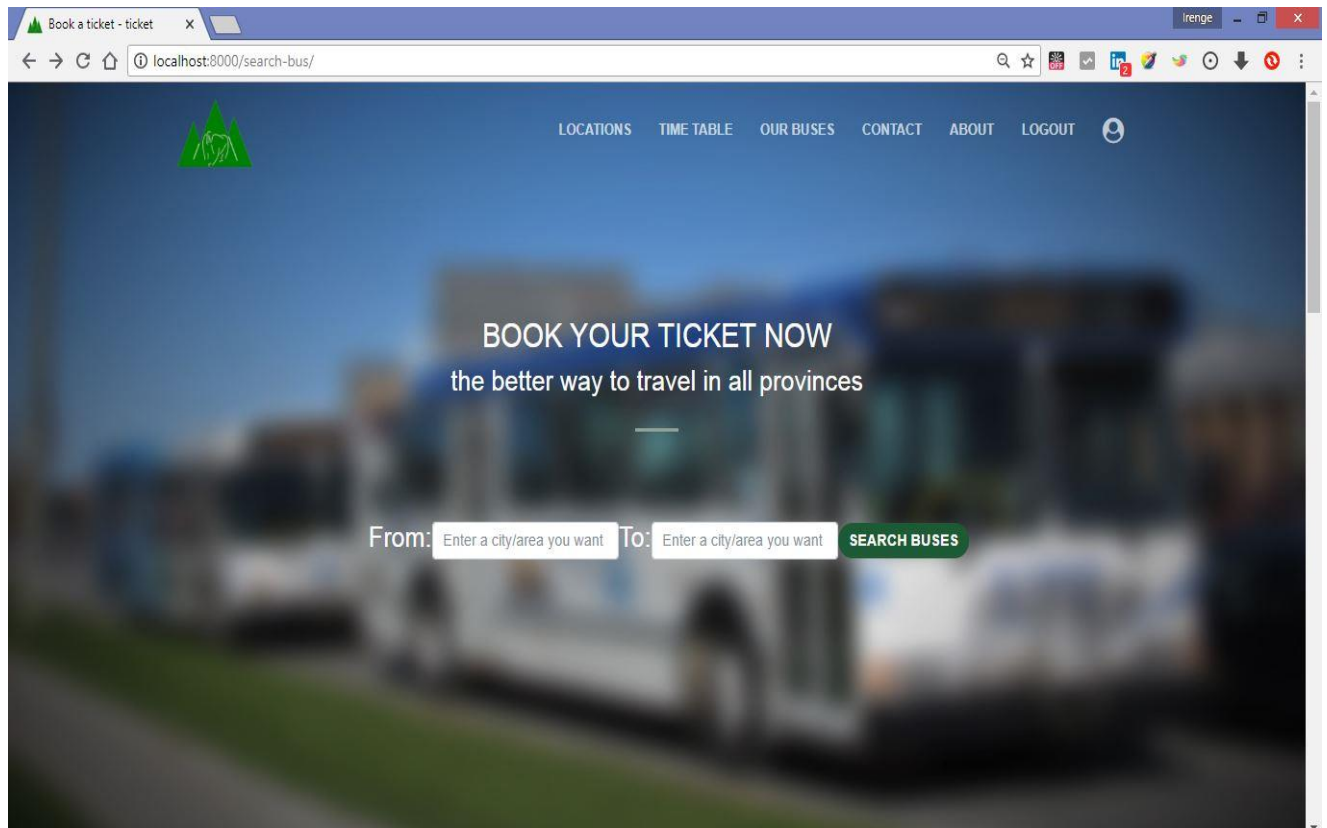


Figure 12: search bus

Source: Own drawing

This page is where customers find the destination and the arrival area . so the customer will be given an auto-completion form providing the programmed places so he can choose where he comes from and where he want to go.


4.1.3. The ticket booking page

Book a ticket - ticket X localhost / 127.0.0.1 | ph X

localhost:8000/book-ticket/2/

LOCATIONS TIME TABLE OUR BUSES CONTACT ABOUT LOGOUT

Bus name: virunga



Price : 3000 FRW/Per person

Depart: 6 a.m.
Arrive : 6 p.m.

Type: AC

testing the departture

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18		
19	20	21	22
23	24	25	26
27	28	29	30
31	32	33	34
			35

Your seats:

your tickets

Email:

Please enter your email

Phone no.:

Please enter your phone no.

Booking Date

mm/dd/yyyy

BOOK TICKET

Figure 13: Ticket booking page

Source: Own drawing

On this is the page is where customers choose their buses and add their personnel information to book their tickets by clicking the Book ticket button. Customers to access this page they have first to be logged in and to search for the programmed areas for the travel.

4.1.4 Login page

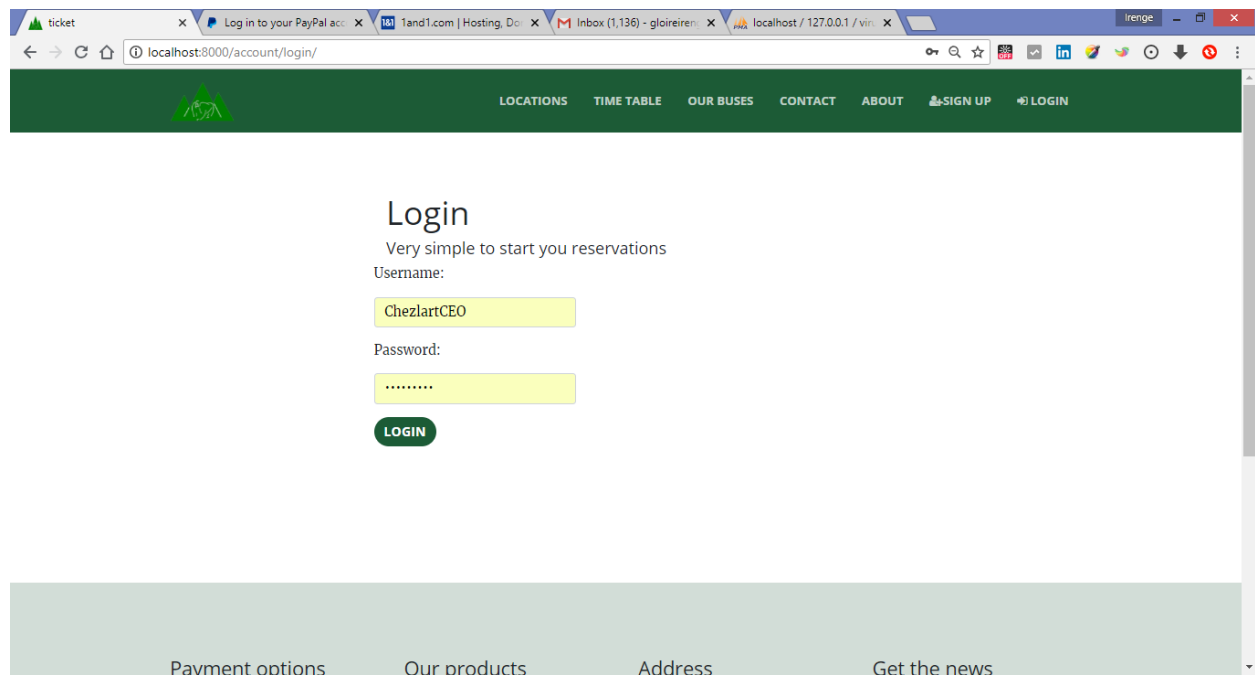


Figure 14: login page

Source: Own drawing

The user login page provides the interface where users can login in order to start their ticket booking process and access their accounts.

4.1.5 Payment page

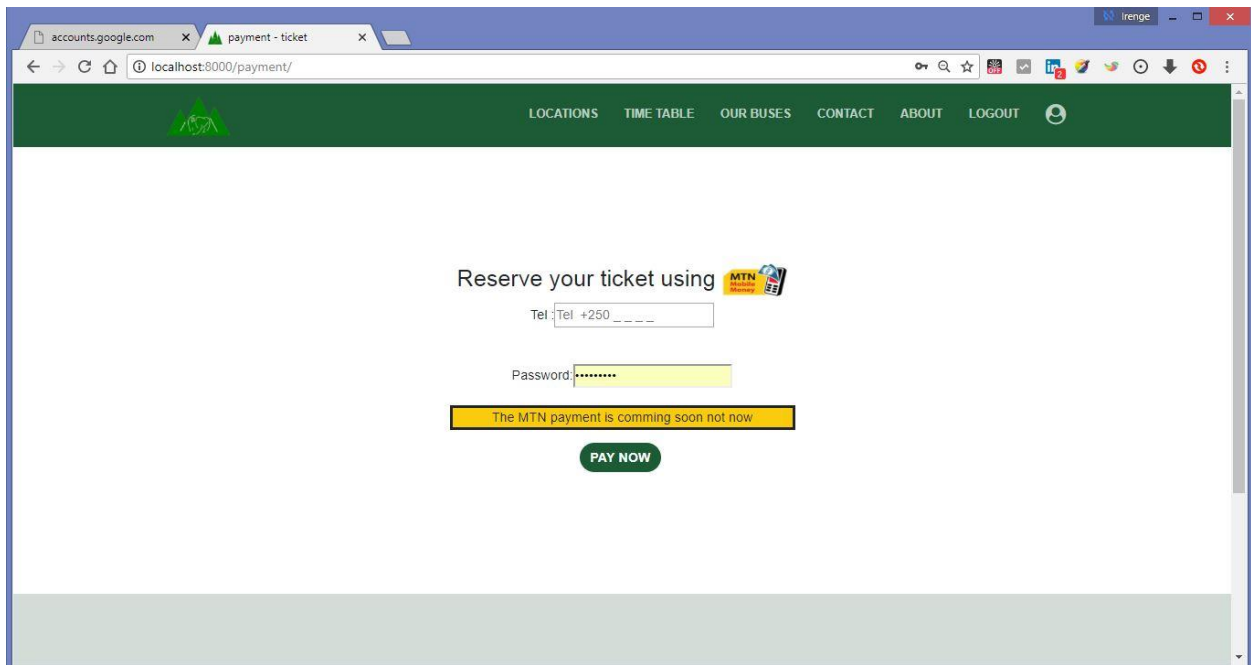


Figure 15: payment page

On this page is where customers will pay their tickets using the MTN mobile money account when it will be available.

Note that the mobile money payment system will be available after the API is bought by the company.

4.1.5 Get your ticket

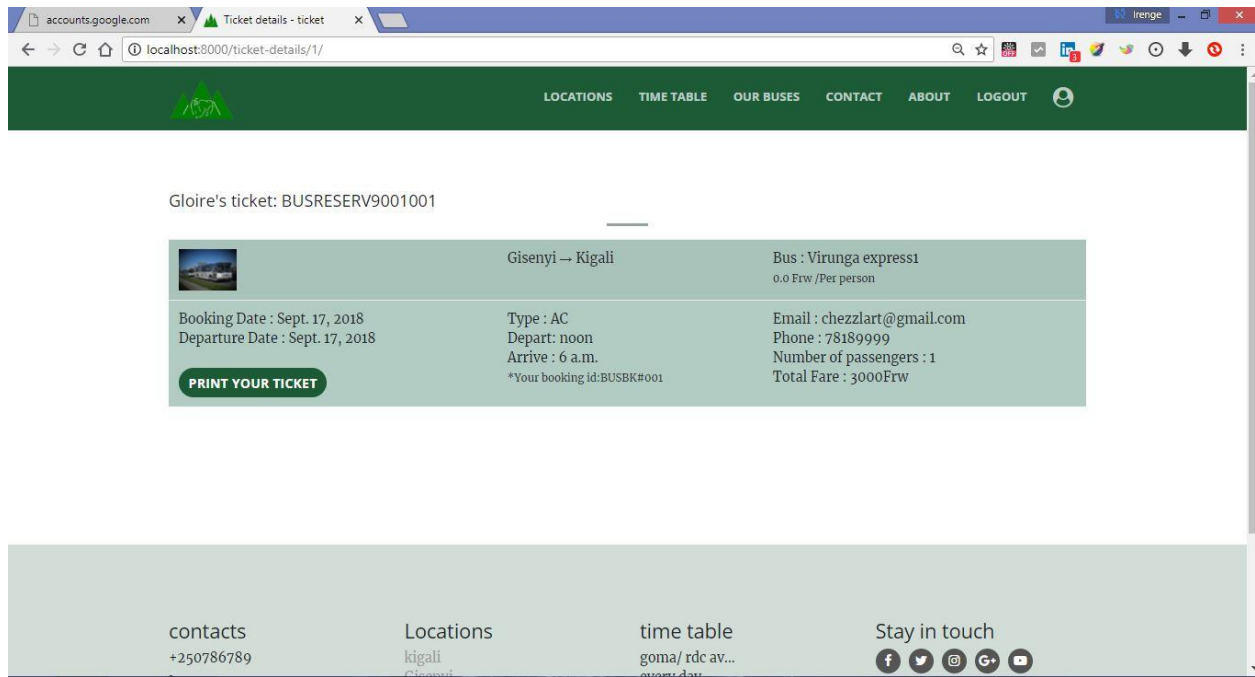


Figure 16: Get your ticket

This is the page that allows customers to get their ticket so they can either print the ticket or take the screen short or images as a proof after the payment process and system verification.

4.1.6 Customer profile page

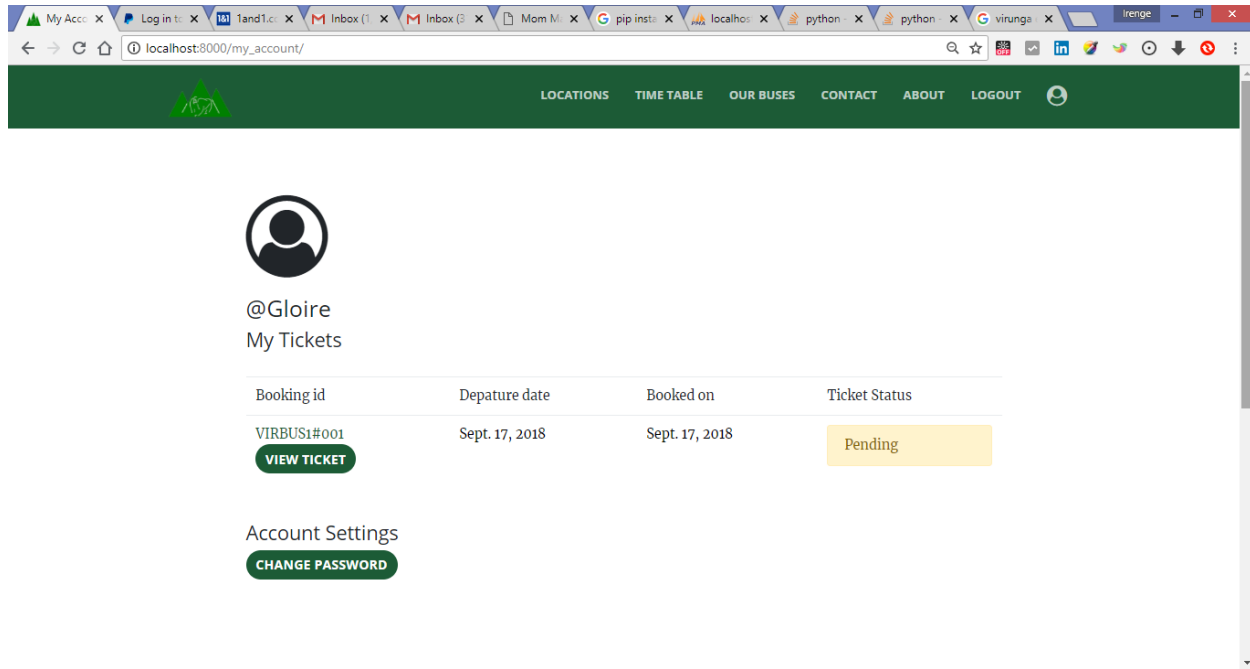


Figure 17: Customer profile

Source: Own drawing

When a customer already has an account and loggingin, he can find all his information in the profile page. All his ticket are shown on his profile to make him aware of all transaction he has made and all the booked ticket are on pending mode as shown in the picture above, until he print them.

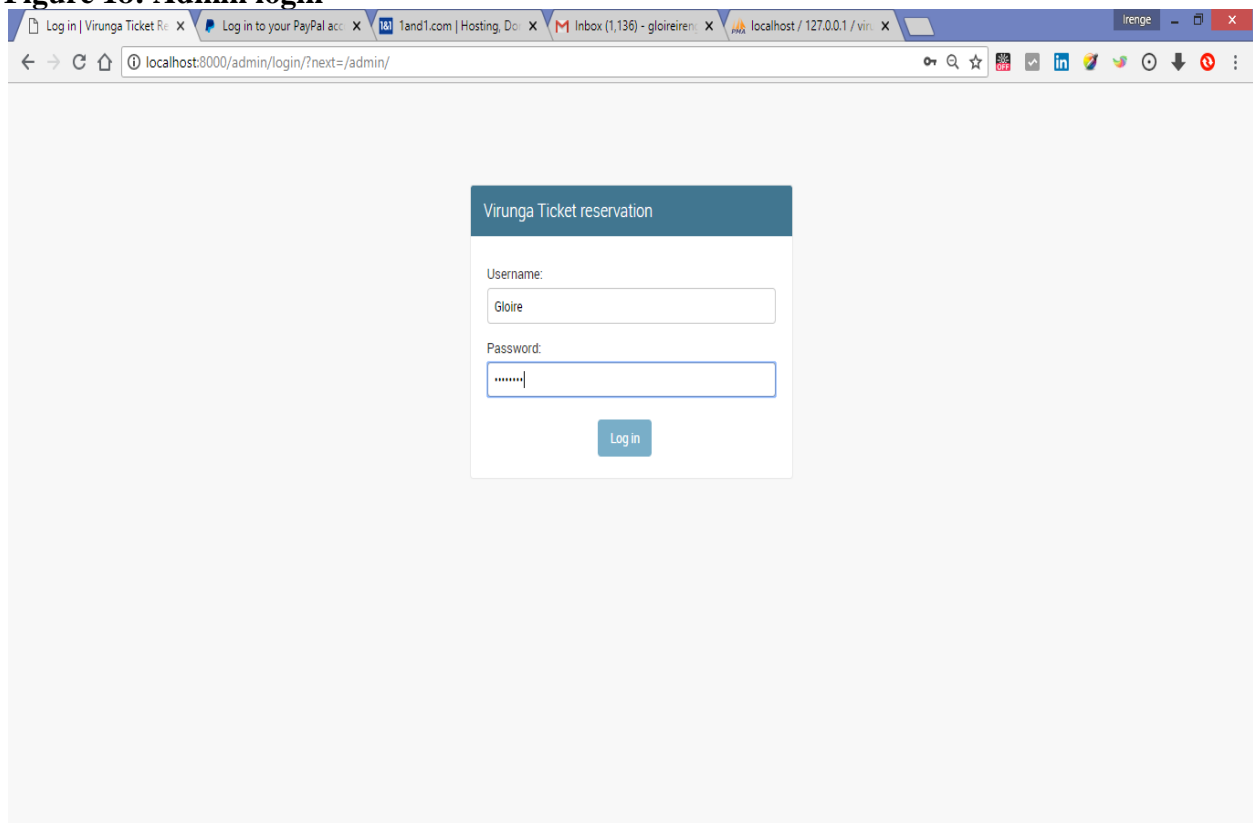
4.2 The administration interfaces

Is the interface where all administrative activities are done such as deleting, update creating information and so on.

The admin has to login and must have the specific permissions to perform the managerial tasks.

4.2.1. Admin login

Figure 18: Admin login

The image shows a web browser window with the address bar displaying 'localhost:8000/admin/login/?next=/admin/'. The page features a login form titled 'Virunga Ticket reservation'. The form has two input fields: 'Username:' with the value 'Gloire' and 'Password:' with masked characters '.....'. A 'Log in' button is positioned below the password field. The browser's tab bar shows several open tabs, including 'Log in | Virunga Ticket Re...', 'Log in to your PayPal acc...', 'land1.com | Hosting, Do...', 'Inbox (1,136) - gloireire...', and 'localhost / 127.0.0.1 / vir...'. The browser's address bar also shows 'localhost:8000/admin/login/?next=/admin/'.

Source: Own drawing

This is where the administrator logs into his account to manage the system.

4.2.2. Admin home page

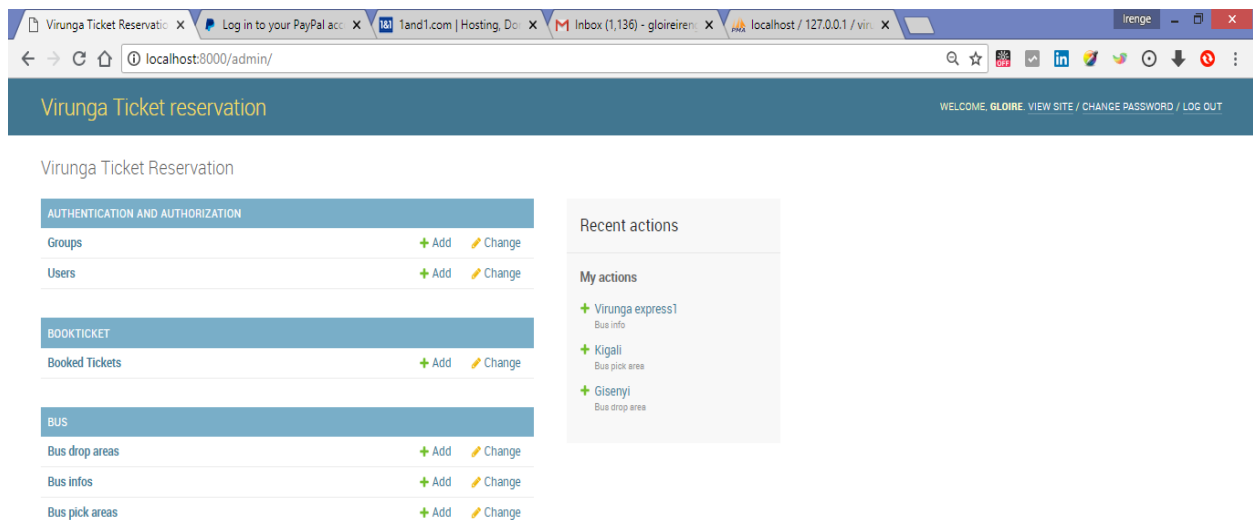


Figure 19: Admin home page

Source: Own drawing

On this page, all information is summarized in titles in order to give a quick management tool to the administrator.

The links that are provided here are:

- The group link which the link is bringing to all other user grouped according to the permission and the access they have in the system.
- The users' link brings us to the page where all information about all users including the admin are stored and managed.
- The booked link brings us to the page that contains all ticket that have been reserved by the customers.
- And the bus info link, the bus drop area and the bus pick area are links that bring us to the pages containing the bus information, the place the buses will take people.

4.2.3. Reserved tickets

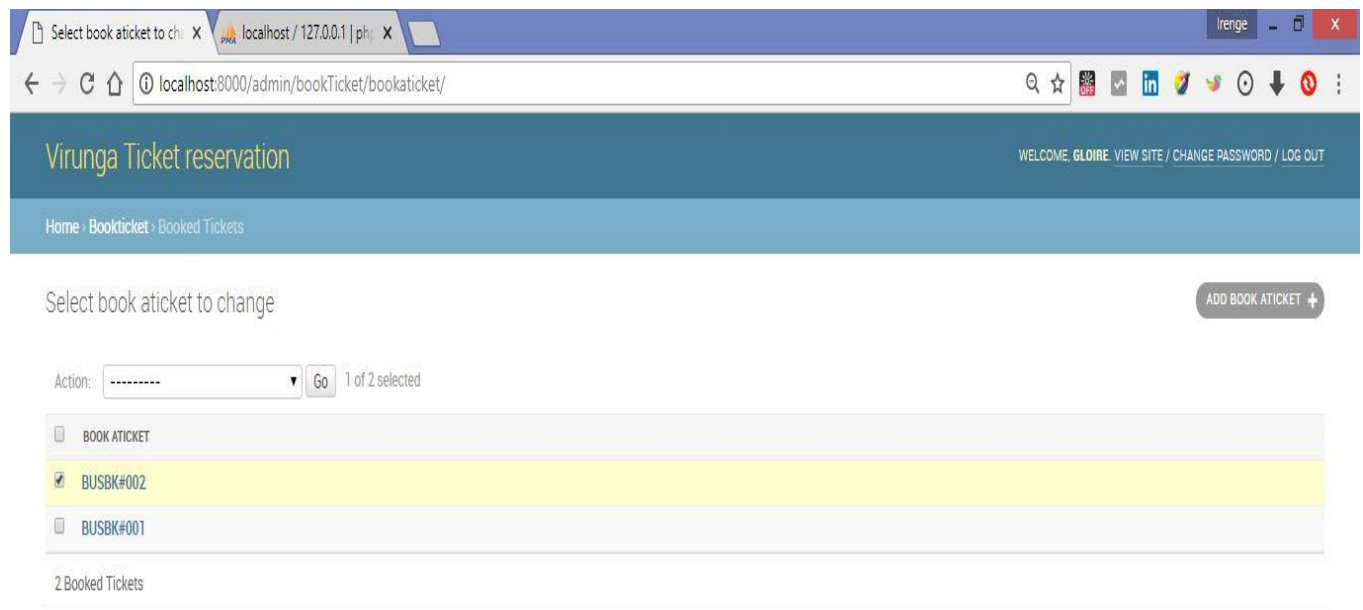


Figure 20: Tickets

Source: Own drawing

This is the form where tickets booked by customers are managed by the administrators, so the administrator can update, delete or can create a new one if required.

4.2.4 Adding the bus pick area

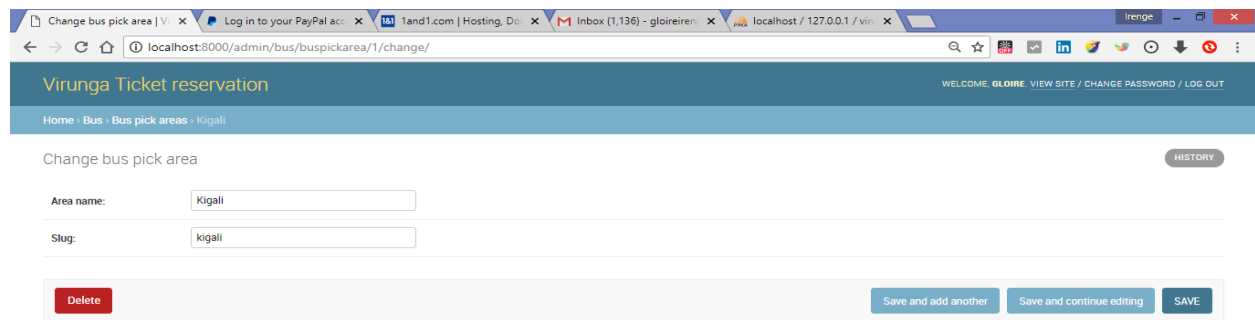
The screenshot shows a web browser window with the URL `localhost:8000/admin/bus/busdroparea/1/change/`. The page title is "Virunga Ticket reservation" and the user is logged in as "GLOIRE". The breadcrumb trail is "Home > Bus > Bus drop areas > Gisenyi". The main heading is "Change bus drop area" with a "HISTORY" button. The form contains two input fields: "Area name:" with the value "Gisenyi" and "Slug:" with the value "gisenyi". At the bottom, there are four buttons: "Delete" (red), "Save and add another", "Save and continue editing", and "SAVE".

Figure 21: Adding the bus pick area

Source: own drawing

This is where the admin specifies from where the buses will take people

4.2.5 Adding the bus drop area



The screenshot shows a web browser window with multiple tabs. The active tab is titled 'Change bus pick area | Virunga'. The address bar shows 'localhost:8000/admin/bus/buspickarea/1/change/'. The page header is 'Virunga Ticket reservation' with a welcome message 'WELCOME, GLOIRE' and links for 'VIEW SITE', 'CHANGE PASSWORD', and 'LOG OUT'. The breadcrumb trail is 'Home > Bus > Bus pick areas > Kigali'. The main content area is titled 'Change bus pick area' with a 'HISTORY' button. It contains two input fields: 'Area name:' with the value 'Kigali' and 'Slug:' with the value 'kigali'. At the bottom, there are three buttons: 'Delete' (red), 'Save and add another' (blue), 'Save and continue editing' (blue), and 'SAVE' (blue).

Figure 22: Adding the bus drop area

Source: own drawing

This is where the admin specifies where the buses will bring Virunga express customers.

CHAPTER V: CONCLUSION AND RECOMANDATIONS

5.1. CONCLUSION

The goal of this work was to develop a system that will help Rwandan bus traveller to reserve their tickets online in order to fight against the time consuming, waste of resources and the customer program failure caused by the lack of a system. So we can now prove those problems are now going to be solved by the best practices used to design and build this online bus ticket and place reservation system.

After analysing the current system, we found that it was very important to come up with a system able to solve the problem. its development was not only a benefit for those Virunga express travellers or the Virunga express company but also for us who developed it because we have sincerely learned so many things in the web programming field.

5.2. RECOMNDATION

As researchers, we cannot put the last dot to this work without giving some recommendations for farther improvement of this project. So we recommend the following to the researcher a specially The ULK GISENYI CAMPUS researcher. The researcher are recommended to improve this work by making it more large that a bus ticket reservation system by adding other services such as passenger automatic maps, travellers' chat boat to make the system a better place for all passengers. We also recommend the Virunga express company to continue using this system in order to improve their productivity and their customer satisfaction.

5.3. FUTURE WORK

Regarding to our work we request the future improvements for this project and those improvements will be including an alert messages to notify customers and integrating the MTN mobile money payment system to make it profitable for even those who don't have visa cards or bank accounts.

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APPENDICES

Index.html

```
{% extends "base.html" %}

{% load staticfiles %}

{% block site_wrapper %}

    {% include 'tags/navigation.html' %}

    {% block content %}

<header class="masthead text-center text-white d-flex">

<div class="container my-auto">

<div class="row">
```

```

<div class="col-lg-10 mx-auto">

<h2 class="text-uppercase" style="padding-top:60px;">

<strong>book a ticket now</strong></h2></div><div class="col-lg-8 mx-auto" >

<hr><p class="text-faded mb-5">Travel easily from any where to every where in Rwandan
provinces by pushing the bellow button to book your ticket</p>

<div class="md-5 col-md-offset-2 column " >

{ % csrf_token % }

<a class="form-group col-xs-12"><a href="{ { 'search-bus' } }" class="btn btn-primary"
style="margin: 6px;"/><i class="fa fa-ticket"></i> BOK YOUR TICKET</a>

</div></div></div></div></div>

</header>

{ % endblock % }

<section id="locations">

<div class="container">

<div class="row">

<div class="col-lg-12 text-center">

<h2 class="section-heading">Our Locations</h2>

<hr class="my-4"></div></div></div>

<div class="container">

<div class="row">

<div class="col-lg-3 col-md-6 text-center">

<div class="service-box mt-5 mx-auto">

```

```
<i class="fa fa-4x fa-map-marker text-primary mb-3 sr-icons"></i>
```

```
<h3 class="mb-3">Gisenyi</h3>
```

```
<p class="text-muted mb-0">You can find us at the bus stop in gisenyi town.</p>
```

```
</div></div>
```

```
<div class="col-lg-3 col-md-6 text-center">
```

```
<div class="service-box mt-5 mx-auto">
```

```
<i class="fa fa-4x fa-map-marker text-primary mb-3 sr-icons"></i>
```

```
<h3 class="mb-3">Kigali</h3>
```

```
<p class="text-muted mb-0">we have so many stations in which you wil find us </p>
```

```
</div></div></div></div>
```

```
</section>
```

```
<div class="container">
```

```
<section class="p-0" id="portfolio">
```

```
<div class="row">
```

```
<div class="col-lg-12 text-center">
```

```
<h2 class="section-heading">OUR BUSES</h2>
```

```
<hr class="my-4">
```

```
</div></div></section></div>
```

```
<div class="container p-0">
```

```
<div class="row no-gutters popup-gallery">
```

```
<div class="col-lg-4 col-sm-6">
```

```
<a class="portfolio-box" href="{ % static 'img/virunga3.jpg' % }">
```

```



<div class="portfolio-box-caption">

<div class="portfolio-box-caption-content">

<div class="project-category text-faded">Firt bus</div>

<div class="project-name">Programed</div></div></div></div>

<div class="col-lg-4 mr-auto text-center">

<i class="fa fa-facebook fa-3x mb-3 sr-contact"></i>

<p><a href="mailto:virungaBusReserve@gmail.com">virunga expres</a></p>

</div></div></div>

</section>

</div></div>{ %include 'tags/footer.html' % } { % endblock % }

```

Search bus form

```

<form method='POST' action="." class="form-inline">

{ % csrf_token % }

<div class="form-group "><label for="area_from">From:</label>

<input type="text" name="area_from" placeholder="Enter a city/area you want to depart from."
id="area_from" class="form-control input-sm "/>

<input type="hidden" name="area_from_id" id="area_from_id" value="1" />

</div>

<div class="form-group ">

<label for="area_to">To:</label>

```

```
<input type="text" name="area_to" placeholder="Enter a city/area you want to arrive to"
id="area_to" class="form-control input-sm"/>
```

```
<input type="hidden" name="area_to_id" id="area_to_id" value="1" />
```

```
</div>
```

```
<div class="form-group">
```

```
<input type="submit" name="search_bus" value="Search Buses" class="btn btn-primary" />
```

```
</div>
```

```
</form>
```

Ticket reservation form

```
<form method="POST" action="." class="form-inline">
```

```
{% csrf_token %}
```

```
<div class="form-group ">
```

```
<label for="area_from">From:</label>
```

```
<input type="text" name="area_from" placeholder="Enter a city/area you want to depart from."
id="area_from" class="form-control input-sm"/>
```

```
<input type="hidden" name="area_from_id" id="area_from_id" value="1" />
```

```
</div>
```

```
<div class="form-group ">
```

```
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```

```
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```

```
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```



```
</div>
```

```
<div class="form-group">
```

```
<input type="submit" name="search_bus" value="Search Buses" class="btnbtn-primary" />
```

```
</div>
```

```
</form>
```